NISTTech

Reducing Heat Losses in Gadolinium Alloys in Room-Temperature Magnetic Refrigeration Processes (Divisional Patent Application)

Improved Magnetic Refrigerant Compound

Description

The invention is a process by which trace amounts of Iron or other suitable metals are added to a Gadolinium-based material used in magnetic refrigeration applications. By adding trace amounts of Iron or other silicide-forming materials to conventional magnetic refrigeration materials, i.e., those based on alloys containing Gadolinium, Germanium and Silicon, undesired hysteresis losses in the magnetic refrigeration process are nearly eliminated. Thus, increased capacity and improved efficiencies can be achieved in magnetic refrigeration in applications at near-room temperature.

See parent patent application under references below.

Applications

- **Refrigeration**

- **Air Conditioning and humidity control**

- **Temperature sensing**

- **Localized cooling (small scale)**

Advantages

- **Relative to vapor-cycle refrigeration, magnetic refrigeration advantages include:**
  Potential for reduced energy consumption and harmful emissions; Elimination of gaseous refrigerants; No noise, moving parts; Low maintenance; Long durability

Abstract

A $Gd_5Ge_2Si_2$ refrigerant compound is doped or alloyed with an effective amount of silicide-forming metal element such that the magnetic hysteresis losses in the doped $Gd_5Ge_2Si_2$ compound are

substantially reduced in comparison to the hysteresis losses of the undoped Gd.sub.5Ge.sub.2Si.sub.2 compound. The hysteresis losses can be nearly eliminated by doping the Gd.sub.5Ge.sub.2Si.sub.2 compound with iron, cobalt, manganese, copper, or gallium. The effective refrigeration capacities of the doped Gd.sub.5Ge.sub.2Si.sub.2 compound are significantly higher than for the undoped Gd.sub.5Ge.sub.2Si.sub.2 compound.

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Citations

1. **NIST Docket Number:** 04-017US
   [U.S. Patent # 7,651,574](#)

References

- U.S. Patent Application # 20100044621
- Docket: 04-017D

Status of Availability

This invention is available for licensing.

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